Unit 7

Spectacles, Optical Prescription and Contact Lenses

Introduction

The topic deals with the process of inspection of prescribing spectacles and dispensing optical prescriptions to patients with visual complaints.

Optical devices include spectacles that correct human vision, which are prescribed by a licensed eye care professional by an authority.

Optical dispensing making the optical devices available to the patient without alteration of a prescription issued by a licensed eye care professional. All contact lenses are to be dispensed in accordance with a valid prescription.

A licensed dispensing optician is a person possessing a valid license by the state, authorised for optical dispensing. The optician will dispense spectacle, contact lenses and optical devices.

A detailed eye examination is performed by an eye care professional; the eye doctor will give a number to the glasses or contact lenses, and will also check the eye for diseases. In case of refractive errors and low vision, spectacles and low vision devices are one of the essential parts of the treatment.

The steps which are followed for provision of refractive services and low vision case are as follows:

- *Screening*: Identification of individuals with poor vision who can improve, by using spectacles or other optical devices.
- *Refraction*: Evaluation of the patient to determine the type of spectacles or device that may be needed.
- *Manufacture*: Manufacture of spectacle or an appropriate device, both of these can be done locally, purchased or can be obtained through donation.
- *Dispensing*: Supply of suitable fitting spectacles or device as per correct prescription.
- *Follow-up*: Fitting or repair of spectacles, devices and re-dispensing can be done as a follow-up.

Session 1: Reasons for Vision Disorders

In this session, you will learn about the reasons causing eye disorders, principle of optics, the different lens powers, and the refractive errors and their remedial measures. Spectacles are prescribed, keeping in mind the conditions of near-sightedness, far-sightedness, and astigmatism.

You may recall

Near-sightedness or myopia

When distant objects are not visible or seem blurred, but nearby objects can be seen clearly.

Factors

1. Heredity plays a major role; where one of the parents has myopia, the children are predisposed to the condition.
2. It is noticed in the child who reports a difficulty in the vision while seeing the blackboard in class or TV screen at home.

Persons with myopia (near-sightedness) can avail any of the following options as part of treatment:

- Spectacles
- Contact lenses
- Refractive surgery procedures

You may recall

Far-sightedness or hyperopia

It is a refractive error when the nearby images of an object are not clear. Persons with far-sightedness can avail the following options as part of treatment:

- Distant vision spectacles
- Reading spectacles
- Contact lenses
- Bifocal spectacles
- Progressive spectacles
- Refractive surgery procedures like LASIK

Astigmatism

It is an imperfection of either the cornea curvature, or the lens index, giving rise to a refractive error when light does not focus properly on the retina, forming distorted images on it. The above conditions are called corneal astigmatism or lenticular astigmatism. Persons with astigmatism can avail:

- Spectacles or contact lenses, with cylindrical correction.
- Refractive surgery procedures like LASIK, PRK, or LASEK.

Types of lenses

Bifocal lenses

These are prescribed for distance and near, to those patients who have distance and near vision problem causing eye strain while looking far away and/or near objects. A small lower part of the lens contains the power required for near-vision correction. The rest of the lens has power for distant vision. The lens segment for near vision correction are of the following shapes:

- a half-moon shaped, D segment or straight-top or flat-top
- a round segment
- a narrow rectangular area, known as the ribbon segment

For distant vision, one has to see through the upper segment of the lens of spectacle. To focus on reading

materials and nearby objects within 18 inches, one has to look through the lower segment of spectacles.

Trifocal lenses

These have three segments of power in a lens—they are for distance, intermediate and near vision. D-bifocal and executive styles are in vogue. Trifocals mostly help drivers who need to have a distant vision to gauge the distance while driving, intermediate vision for dashboard viewing, and near vision for viewing road maps; it is also of use for painters, lawyers and teachers who need to see frequently at three different levels.

Contact lenses

These are used for optical correction, worn in close contact to the cornea to correct defective vision. They provide better field of vision and have several advantages over spectacles. Contact lenses do not collect moisture. They can be worn in all conditions, like rain and excessive sweating. These are best used in outdoor activities as for pilots, sports persons and astronauts. Corrective contact lenses are used to improve vision by correcting the visual error.

Power of lenses

There are two types of lenses:

(a) Plus-powered lenses
(b) Minus-powered lenses

Plus-powered lenses

They are thicker at the centre than the edges. These lenses magnify images so that the images appear bigger.

Minus-powered lenses

They are thinner at the centre and thicker at the edges. They do not magnify images; thus, the images appear to be smaller. Optical lenses can be spherical or cylindrical lenses.

Correction of refractive errors

Myopia is corrected by concave lenses and hyperopia is corrected by convex lenses (Fig. 7.1). To correct astigmatism,

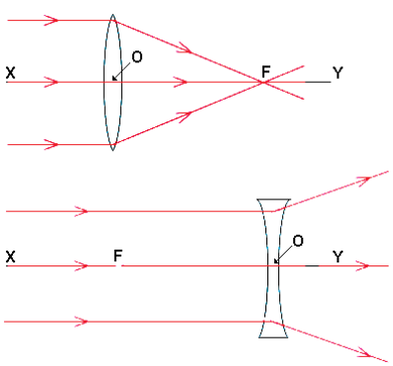

Fig. 7.1: Correction of refractive errors

a cylindrical lens is used. The refractive power is measured in optical units called dioptres. This measurement is indicative of the refractive power that the lens has. The higher the dioptre, the stronger the lens.

Practical Exercises

1. Give a solution to this case scenario:
   (a) student in the classroom comes to the teacher and complains that she cannot see the blackboard clearly. What eye disorder could the student be suffering from? Explain its treatment.
   (b) A doctor is treating a patient and finds out that his family has a history of eye disorders. What types of refractive errors could the patient suffer from?
2. Visit an eye unit or clinic to study the system of dispensing optical prescription and study the optics of various lenses.

Check Your Progress

A. Fill in the blanks

1. Astigmatism is an imperfection of either the _____ or the _____.
2. Trifocal lenses have three levels of focus_____, _____, and _____.
3. Contact lenses are _____ _____ worn in close contact to cornea to correct the _____ vision.
4. Hyperopia is corrected by _____ lenses.
5. The refractive power is measured in _____ units called _____.

B. Short answer questions (30-40 words)

1. What are the different types of lenses?
2. How can refractive error be corrected?
3. What is an optical centre?
4. What is dioptre?

C. State whether the following are True or False.

1. Far-sightedness is a refractive error.
2. Heredity plays a major role in the onset of myopia.
3. Bifocal lenses contain three segments of power.
4. Trifocal lenses correct disorders of accommodation.
5. Contact lenses collect moisture.
6. Myopia is corrected by convex lenses.

Session 2: Optical Prescription Notation

In this session, you will learn about the optical prescription notation. In order to dispense optical prescriptions and provide the correct spectacles, the optician has to understand the prescription written by an eye care professional. Optical prescriptions are written in a standard format. Latin abbreviations are in vogue for writing eyeglass prescriptions.

Table 7.1: Optical Prescription

Name : Vijay Anand Joshi					
Age: 68 yrs		Occupation: Ophthalmologist		Contact No.	
Address: PSS Central Institute of Vocational Education, Shyamla Hills, Bhopal					
Previous Glasses	-1.00/-2.00X90°		-0.50X100°	+2.25	
Spectacle Prescription					
RX	Sph.	Cyl.	Axis	Add.	Vision
Right Eye	-1.00	-1.75	90°	+2.25	6/9
Left Eye	-1.25	-0.25	90°	+2.25	6/6
					Optometrist Signature

Common abbreviations

Sph : Sphere or spherical power
Cyl : Cylinder or a power that corrects astigmatism
Axis : the angle, in degrees, between the two meridians present in an astigmatic eye
D : the unit to measure the correction or the focussing power also known as dioptre

The general form of writing the prescription for astigmatism is Sph x Cyl x Axis

SVD : Single Vision Distance. It prescribes glasses for distant vision only.

SVN : Single Vision Near. It prescribes glasses for reading only.

IPD : Inter Pupillary Distance. It denotes the distance between the centres of the two pupils. This measurement fulfills the criteria of preparing and designing of comfortable and optically perfect spectacles; also useful to decentre the lens while fitting bifocal or multifocal lens in spectacle frames.

Notations used in optical prescriptions

Following is an example of optical prescription:

OD: -3.00-0.50 X 180
OS: +2.00 DS
ADD: +1.75 OU

- The letter OD stands for 'oculus dexter'. It indicates the right eye.
- The letters OS stands for 'oculus sinister'. It stands for the left eye.
- RE for Right Eye and LE for Left Eye and BE for both Eyes are in vogue.
- The first number to the right of OD is -3.00. It indicates the sphere part of the prescription.
- The sphere number denotes either nearsightedness or far-sightedness.
- The sign of negative (–) shows the negative power of the lens used to correct near-sightedness or myopia.
- In case of a (+) sign, it is used for the lens to correct far-sightedness or hyperopia.
- The next number to the right of the spherical number is $-0.50X180^0$.
- This number stands for the cylinder part of the prescription.
- The next number adjacent to the cylinder number –0.50 is x 180.
- This is referred to as 'axis 180'.

- In the next line, +2.00 represents the sphere number for the left eye. The letters DS, mean 'diopters sphere'.
- It specifies that the correction for the left eye is spherical in nature and does not have astigmatism.
- Finally, the column of near which reads ADD: +1.75 OU denotes the power that needs to be 'added' to the distance prescription for both eyes to resolve the nearness focussing problems. These 'add power' or a 'bifocal power' helps the patient for reading and close range activities.
- Therefore, from the above example, we can calculate the total power needed for single vision reading glasses.
- The prescription for reading glasses for the right eye would be: -3.0 DS – 0.50X180
- The prescription for the left eye would be: +2.0 DS = +2.0 DS
- Add BE+1.75.

Practical Exercise

Visit an eye care unit or clinic to learn the techniques of transposition of optical prescription.

Check Your Progress

A. Fill in the blanks

1. Optical prescriptions are written in _____.
2. _____ is the unit to measure the focussing power, also known as _____.
3. The letter OD stands for _____ _____, it indicates the right eye.

B. Short answer questions (30-40 words)

1. An optometrist has to give bifocal lenses to a patient. How should he/she add the 'add power'?

2. An optometrist wants to compare the present refraction with the previous prescription. What should he do?
3. What is cylinder power?
4. What does OU stand for?

C. State whether the following are True and False

1. Optical prescriptions are written without any standardised notation.
2. Spherical power has same power in all meridians.
3. In transposition, the sign of the sphere is changed.
4. The general form for writing a prescription for astigmatism is Sph + Cyl x Axis.

Session 3: Principle of Foci Meter and Types

In this session, you will learn the principle of foci meter and the types of foci meters.

Fig. 7.2: Foci meter

What is a foci meter?

A foci meter (Fig. 7.2) is an instrument which is customised to measure vertex powers and prismatic effects of the spectacle and contact lenses, to mark uncut lenses and to verify the accurate mounting of lenses in spectacle frame.

Functions of a foci meter

The functions of a foci meter are to

- check the existing spectacles of patients;
- check new eyeglasses and verify their powers;
- check the powers of lenses in the laboratory;
- facilitate the marking and setting of uncut lenses before glazing;
- measure the spherical lens power, the cylindrical power, and verify the reading addition;

- mark the actual optical centres of the lenses; and
- find the axis direction of the cylindrical lenses.

Types of foci meter

Foci meters vary according to the type of target viewed through the instrument.

Fixed ring target

An array of dots which distorts linearly according to the power of the lens viewed.

Rotating line target

The target will be observed as a line when rotated to match the cylinder axis.

Projection foci meter

Uses a screen to present an electronically generated image.

Lens meter

An automated device used to interpret the refractive power of the lens being assessed.

Neutralisation of lenses

Hand neutralisation is in use to determine the power of a lens. This type of neutralisation is time-consuming and susceptible to subjective error. Thus, foci meters are in vogue in place of hand neutralisation.

Process of hand neutralisation depends on the following principle:

While looking at an object through a lens, move the lens simultaneously to make the object appear to move too. Depending on the type of lens, the movement of the object will vary. If the chosen lens is convex, i.e., positive, the object will appear to move in the direction opposite to the direction in which the lens is moved.

This is said to be the 'against' movement; whereas if the lens is concave, i.e., negative, the object will seem to move in the direction the lens is moved or a 'with'

movement. So, when a pair of lens of equal but opposite powers is put together, there occurs zero movement of the object. This allows to measure the power of the lens. This method is used to verify spectacle correction by an optometrist.

Spectacle correction by foci meter

This is achieved through the following steps:

- A dot is placed in the lens at the optical central position.
- The lens is then placed on the lens table with the centre dot in the centre of the rest.
- Now the target is brought into focus.
- The target is displaced, as there is prism in the lens.
- The target gets displaced in the direction of the base of the prism.
- For prism base up, it gets displaced up and for prism base down it gets displaced down.
- The target gets displaced to the right for base-in prism for the right eye and base-out prism for the left eye.
- Similarly, the target is displaced to the left for base-in prism for the left eye, and base-out prism for the right eye.
- The axis ring is rotated so that the meridian cross-line cuts through the centre of the target.

Practical Exercise

Visit an eye care unit or clinic to observe the operation of a foci meter and determine the power of an unknown lens.

Check Your Progress

A. Fill in the blanks

1. Foci meters vary according to the type of _____.
2. For convex lens, the object will appear to move _____ to the direction of the lens moved.
3. Foci meter is an instrument which is customised to measure _____ and _____.

B. Short answer questions (30-40 words)

1. What is a foci meter?
2. What are the types of foci meters?
3. What is hand neutralisation?
4. How is spectacle correction done by foci meters?
5. A patient has been using spectacles and has come for correction of power. What instrument will be able to measure it and how?
6. A patient has come to the clinic after he was prescribed a spectacle correction. What procedures were carried out for the correction?

C. State whether the following are True and False

1. Foci meters measure the power of existing lens only.
2. Foci meters are never used in the laboratory.
3. There exists only one type of foci meter.
4. Hand neutralisation is a time-consuming process.